Spectral-Fluorescence Properties of the Sr_3 $LaMe_3O_{12}$ (Me = Nb, Ta) CrystalsActivated by Nd^{3+} Ions

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In this report, the results on spectral and kinetic investigation obtained by site- selective laser spectroscopy of the Sr_3 $LaNb_3$ O_{12} (SLN) and the Sr $_3$LaTa $_3O_{12}$ (SLT) crystals doped with Nd^{3+} ions are presented. The Nd^{3+} ions concentrations in studied crystals were 0,5 – 5 weight %. Time resolved fluorescence spectra ($^4F_{3/2} \rightarrow {}^4I_{9/2}$; $I_{11/2}$) and laser excitation spectra ($^4I_{9/2} \rightarrow {}^4G_{5/2}$; $^2G_{7/2}$) were registered at 77 and 300K.

Results show the creation of the three types of centers of Nd^{3+}, A,B,C ,in the SLN crystal and only two types of centers in SLT, B´and C´, similar to B and C centers in SLN.

Neodimium ion was found to occupy mainly two positions with different surroundingswhich correspond to the B and C centers. Also, the crystal field fluctuations result in the inhomogeneous distribution of energies of the [$^4F_{3/2}$ (1)$\rightarrow {}^4I_{9/2}$(1)] electronic transition of the Nd^{3+} ions with spectral broadening equal to $\Delta\nu_{inhm} = 17sm^{-1}$ for both B, B$^{'}$ and C, C$^{'}$ centers. The magnitude of homogeneous broadening [δ_{hom} (ν) = $27sm^{-1}$] of the $^4F_{3/2}(1) \rightarrow {}^4I_{9/2}(5)$ transition of A-center is determined at 300 K. There are proposed different models of the Nd^{3+} optical centers formation in used crystals matrices. It is shown that B, B´ and C, C´ optical centers have C_{3v} point group symmetry. Energy level diagrams of Stark-splitting of spectral terms $^4I_{9/2}$; $^4I_{11/2}$; $^4F_{3/2}$; $^4G_{5/2}$; $^2G_{7/2}$ of the A, B, B´, and C, C´ centers are obtained. By means of fluorescence line narrowing the kinetics of fluorescence decay and lifetimes of excited $^4F_{3/2}$ state for the A, B, B´, and C, C$^{'}$ - centers are measured. The Nd^{3+} - Nd^{3+} inter-center energy transfer in SLN crystal was observed.